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ABSTRACT

Important events and information about the PLATO system featured in this document include a short history of the development of the PLATO system, a list of the PLATO project's financial supporters, a chronological rundown of highlights in PLATO's history, and an extensive bibliography of resources about PLATO published between 1961 and 1981. A map of PLATO system sites is also included, as well as graphs showing PLATO usage. (ILS)

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PLATO® HIGHLIGHTS

by

Elisabeth R. Lyman

COMPUTER-BASED EDUCATION RESEARCH LABORATORY

UNIVERSITY OF ILLINOIS, URBANA, ILLINOIS

OCTOBER, 1981

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TABLE OF CONTENTS

Development of the PLATO System.....5

Principal Financial Supporters of the CERL PLATO System.....13

Highlights in the History of the PLATO Project.....14

Chronological List of PLATO Publications.....21

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TABLE OF FIGURES

U of I PLATO System Sites.....3

U of I PLATO System Terminals.....4

U of I PLATO System Computers.....6

PLATO Lesson Programming Languages.....6

Instructional Material, U of I PLATO System.....8

U of I PLATO System Usage, 1960-1974, Students Only.....10

U of I PLATO System Usage, 7/1/1974 - 9/1/1981.....11

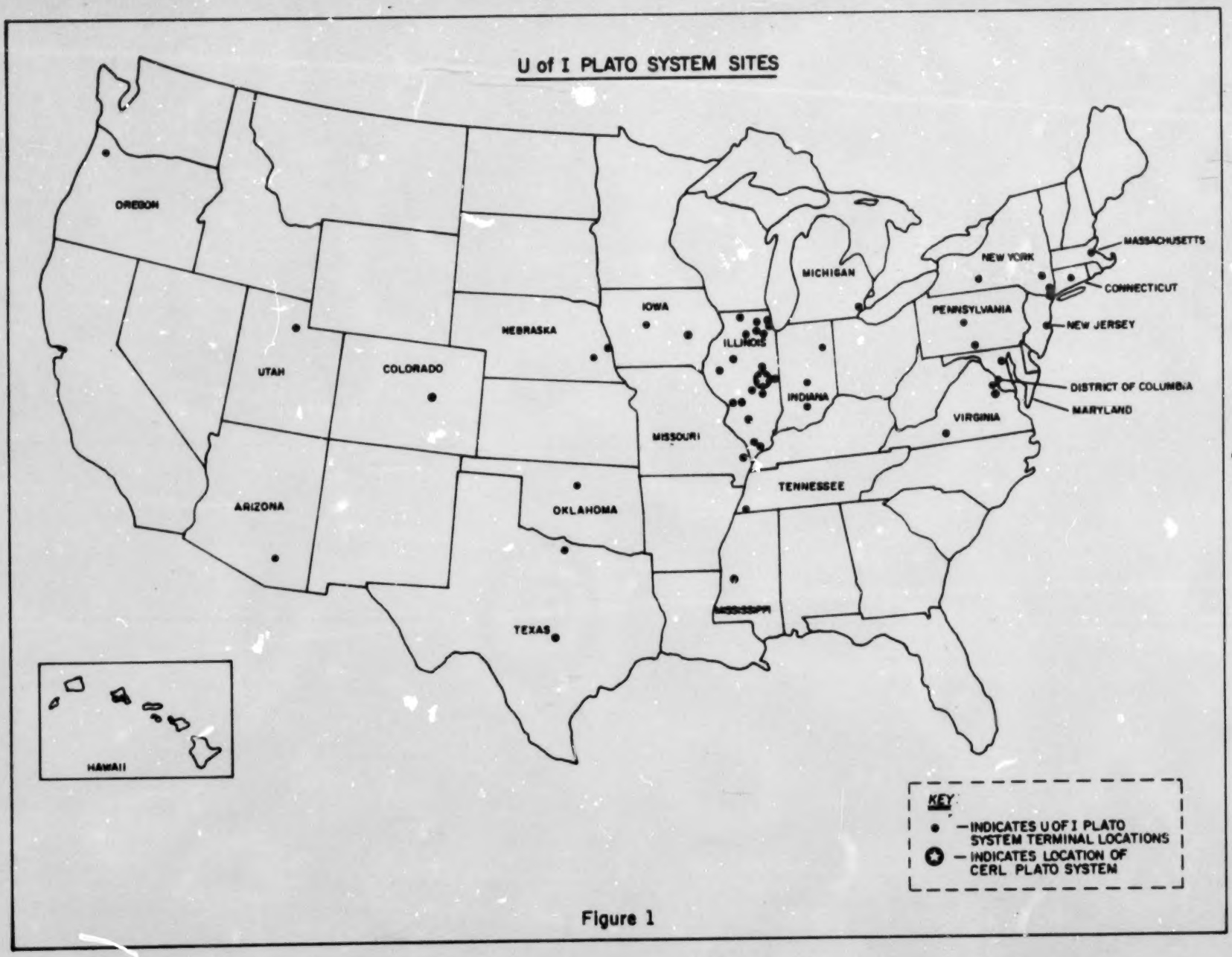
U of I PLATO SYSTEM SITES
OREGON
UTAH
COLORADO
NEBRASKA
IOWA
ILLINOIS
MICHIGAN
NEW YORK
MASSACHUSETTS
CONNECTICUT
PENNSYLVANIA
NEW JERSEY
INDIANA
DISTRICT OF COLUMBIA
MARYLAND
VIRGINIA
MISSOURI
TENNESSEE
ARIZONA
OKLAHOMA
TEXAS
MISSISSIPPI
HAWAII
KEY
• — INDICATES U OF I PLATO SYSTEM TERMINAL LOCATIONS
✪ — INDICATES LOCATION OF CERL PLATO SYSTEM

Figure 1

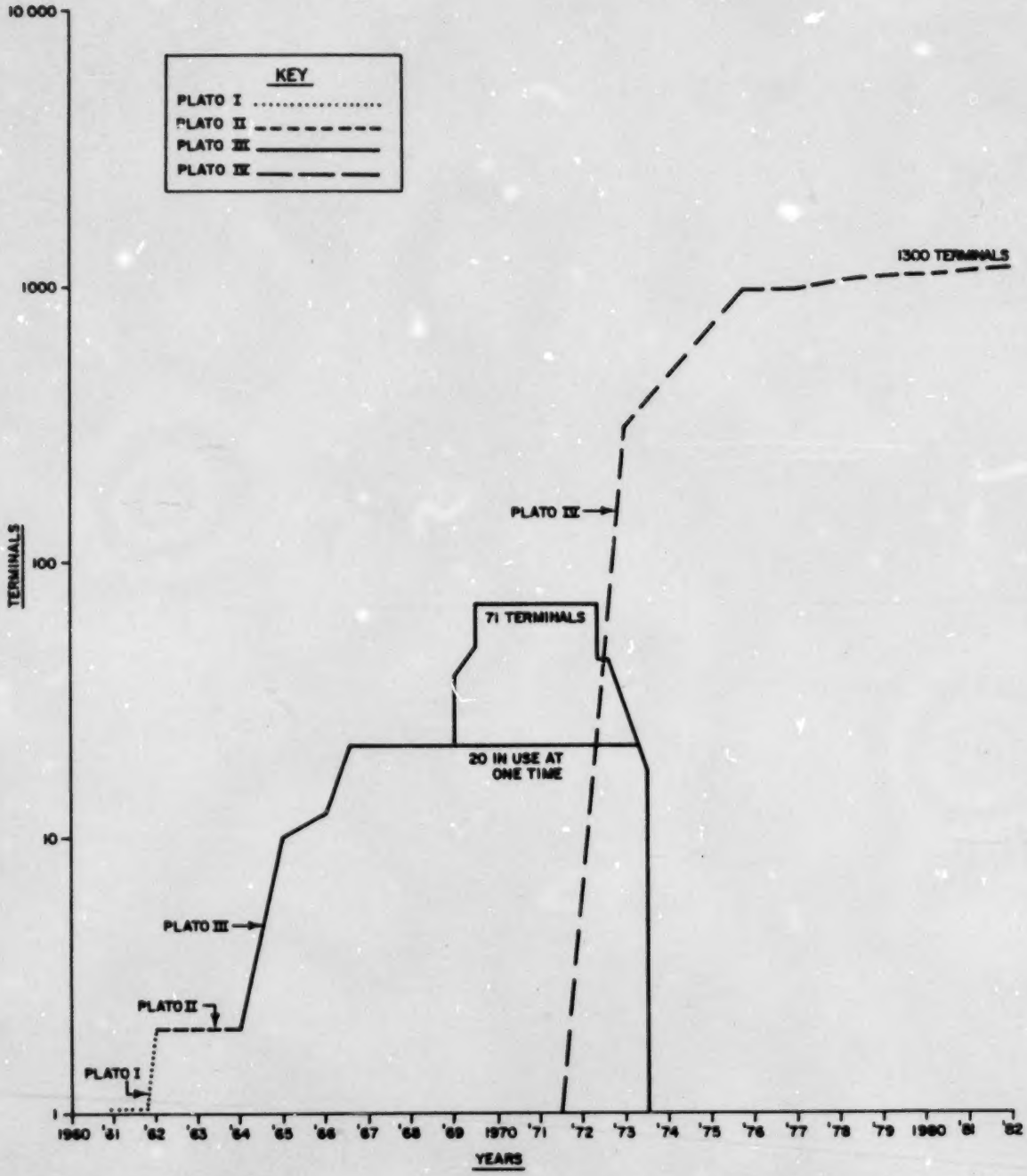

Figure 2 U of I PLATO SYSTEM TERMINALS

Development of the PLATO System

As a result of conversations in 1959 among engineers, physicists, psychologists and educators, research was started in 1960 in the Coordinated Science Laboratory at the University of Illinois to explore the possibilities of automation in individual instruction. A teaching system called the PLATO system (Programmed Logic for Automatic Teaching Operations) was invented and developed initially in the Coordinated Science Laboratory under the direction of Dr. Donald Bitzer. The system utilized a high speed digital computer as the central control element for teaching a number of students simultaneously.

In the course of the first seven years of the PLATO system's existence, the system grew from one terminal to seventy-one (twenty of which were operable simultaneously) (Figure 2), utilized three different computers (Figure 3) and employed four languages (Figure 4). During this period about 300 programs, of which 180 were lessons, were written for the system to illustrate or demonstrate its flexibility for teaching as well as for educational and other research (Figure 5).

In January 1967, the University of Illinois organized the Computer-based Education Research Laboratory and moved the PLATO project from the Coordinated Science Laboratory into the new laboratory. Dr. Bitzer continued the direction of the PLATO development. The purpose of the new laboratory was to continue the research and operation of the PLATO system. Work in the laboratory concentrated on the educational aspects of the PLATO III teaching system with particular emphasis on the most efficient use of PLATO III (the twenty terminal system) and on the development of the hardware (equipment), software (basic computer programs), and courseware (educational materials) for an economical large-scale computer-based educational system (PLATO IV).

From 1967 through 1972 the use of the PLATO III system reached peak capacity with approximately sixty hours assigned to student class time per week (Figure 6) and authors relegated to writing their lessons on the system from late evening until the early hours of the morning, while system programmers had to experiment on and correct the basic program problems during the rest of the night. The storage medium for PLATO lesson material was changed from magnetic tape to disk storage and the interactive interpretive program for the TUTOR language improved to allow time-sharing of the system by students and authors simultaneously as well as to add new features to the language. The computer and the available materials were then being used as efficiently as possible. Lesson material proliferated rapidly (Figure 5) and work in many new subject areas was tried.

The actual testing of the large scale computer-based educational system, PLATO IV, began with the arrival of many commercially manufactured PLATO IV terminals during the summer of 1972. These terminals utilized plasma display panels as the visual display rather than storage cathode ray and television tube presentation. Extensive development of the TUTOR language for PLATO IV enabled PLATO authors to

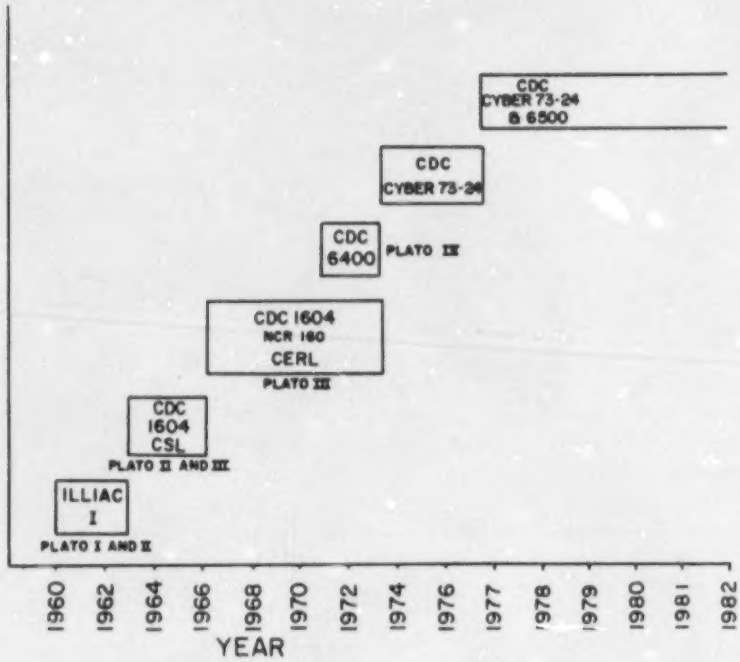

Figure 3 U of I PLATO SYSTEM COMPUTERS

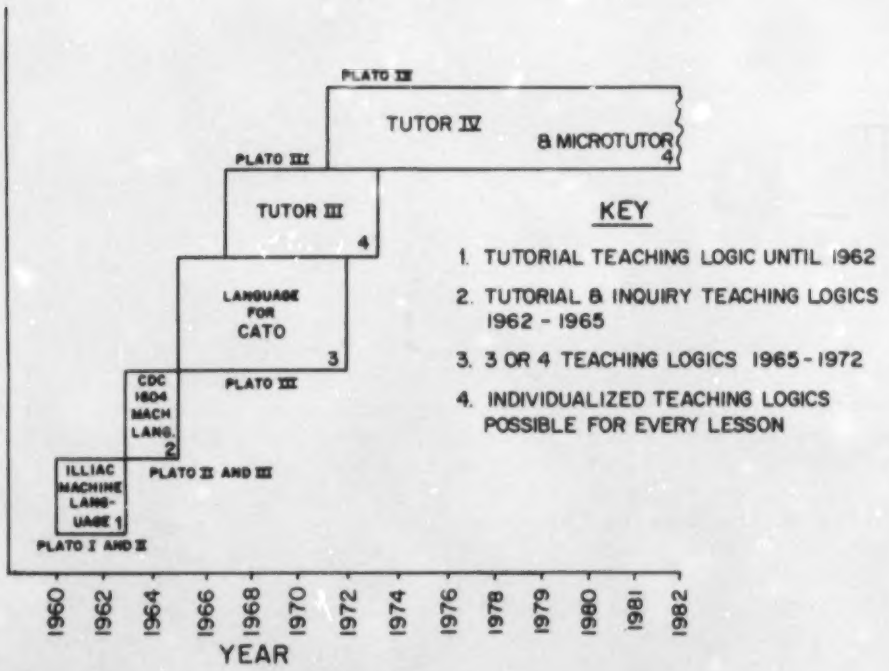

Figure 4 PLATO LESSON PROGRAMMING LANGUAGES

convert their PLATO III lessons to the PLATO IV system and to develop new PLATO material. Classes taught using PLATO IV terminals officially began in February 1973 and the teaching with PLATO III was phased out in June of that year.

Concurrent developments of improvements to the computer system, of the design and construction of auxiliary equipment, of the scope of the TUTOR language and of curricular materials has been the PLATO project pattern since 1973. Every phase of the system has either been improved or expanded. In February 1973, a new Control Data Company computer, CYBER 73-24, replaced the CDC 6000 series machine (Figure 3) and in February 1976 a CDC 6500 machine was added to operate simultaneously with the CYBER 73-24 to run the system. Extended core storage memory (ECS) was increased in February 1974 by 500,000 words to a total of one million words and in December 1974 to a total of two million words. Expansion of the disk storage system continued as needed with fourteen drives being in operation by January 1977. By March 1980 twenty-four disk drives were in operation making many thousand files available to the users at any time. The disk system has continued to expand and currently provides for the storage of 4.2 billion characters, any of which are available at any time to the users. A random access slide projector, a touch panel attachment, a random access audio facility, and a music synthesizer were developed as auxiliary equipment for the terminal. In the spring of 1977 one million words of auxiliary memory (AMS) were made available to the system. The AMS is a low-cost ECS equivalent memory developed by CERL. In the winter of 1980, an additional one million words of AMS were installed. A second generation version of the PLATO terminal, the PPT (PLATO Programmable Terminal) was designed, tested and put into production with one hundred of the new terminals being added to the present PLATO system during the fall of 1977. A floppy disk system was also designed to provide local mass storage at the terminal. With this device and the use of the μTUTOR language, it is now possible to operate the PLATO terminal off-line from the central computer system and still deliver the same high quality PLATO courseware.

The present UI PLATO system supports approximately 1300 terminals at over 200 locations, forty-four on the campus of the University of Illinois and the others scattered throughout the United States including Hawaii. Delivery of PLATO software and courseware using cable television technology and cluster PLATO systems are also being studied.

Along with the hardware development, the software for the system has been immeasurably improved. Many of the sophisticated refinements and extensions of the TUTOR language have been a result of suggestions from the many users on the system, suggestions arising as the users experimented with and developed curricular materials. The language is now highly flexible and offers capabilities from complex calculations for dazzling graphics to powerful judging routines. The TUTOR language has also been greatly expanded.

Sixteen other PLATO systems are now in operation located respectively in Minneapolis, Minnesota; Tallahasse, Florida; Newark, Delaware; Sunnyvale, California; Toronto and Edmonton, Canada; Belgium;

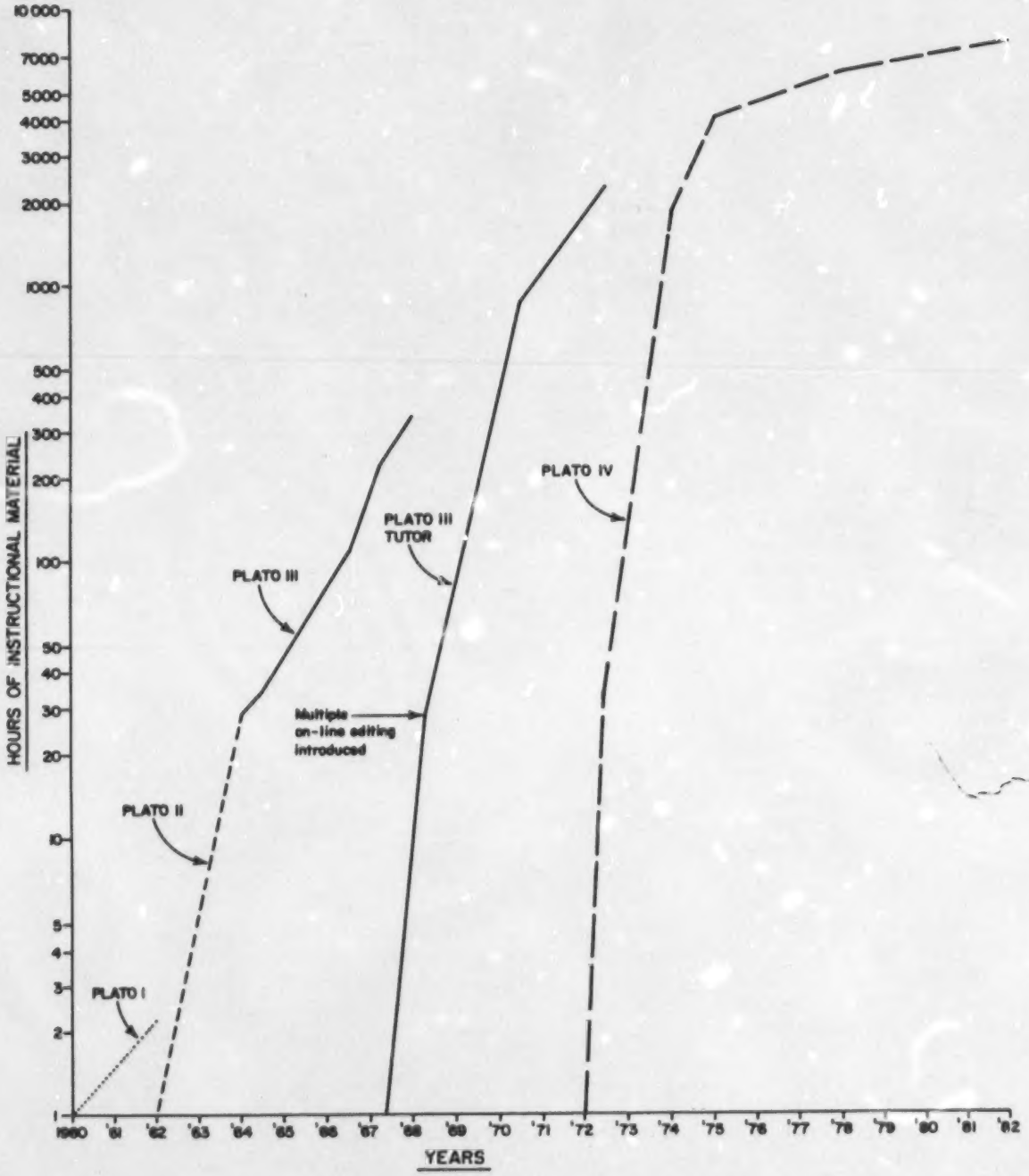

Figure 5 INSTRUCTIONAL MATERIAL - U of I PLATO SYSTEM

the United Kingdom; Sweden; Korea; Australia; and South Africa. The systems operate independently, but many are linked together for intersystem communication. As anticipated technological developments improve computer and communications systems, an international grid is forming of compatible PLATO regional networks providing a sophisticated computer-based information/communications network.

Besides the intersystem interaction of PLATO systems, all kinds of interterminal communication are possible: message exchange, consultation for lesson-writing and other programming aid, forums and rapid information interchange.

Curricular material development for the University of Illinois PLATO system enjoyed a major emphasis during the four years, 1972-1976 (Figure 5). Particular attention was paid between 1974 and 1976, at the request of those supporting the laboratory, to materials for the community college level and for elementary reading and mathematics. Teaching materials, however, for many other areas have also been written. Materials which have been tried out in the classroom are now available for about 7500 instructional hours in about 150 subject areas. Details on the available PLATO curricular materials are to be found in the catalog, "CERL PLATO Curricular Materials" (April 1980) and its supplement (October 1981).

The increase in student contact hours on the PLATO system from 1960, the inception of the system, to 1974, two years after the PLATO IV system installation, is plotted in Figure 6. Accurate data available on the usage of the system by both authors and students for the years from 1974 to the present are shown in Figure 7. 9,600,000 terminal hours of use by students and authors were recorded between July 1, 1974 and September 1, 1981.

In the spring of 1976, following legal negotiation between the University of Illinois and Control Data Corporation, the Control Data Corporation announced plans for marketing PLATO systems and the establishment of learning centers in metropolitan areas around the United States operated by the CBEducation Corporation. University of Illinois Courseware transfer to CDC systems has subsequently taken place as authors have offered their lessons to Control Data Corporation for publication on its or other PLATO systems.

Although the initial goal of the developers of the PLATO system was the provision of low-cost high quality computer-based education for thousands of users, the flexibility and scope of the system have led to a much wider variety of uses than ever initially imagined. Instruction is carried on at all levels from tiny youngsters to adults, from college-bound to vocational trainees, for those needing remedial, corrective or just supplementary work in schools, corrective institutions, businesses and military training centers. Non-instructional applications range from entertainment, to business to personal services (medical appraisals, career planning, psychological testing, etc.), on-line research, data processing and information retrieval. The ideas for uses of the system are unlimited.

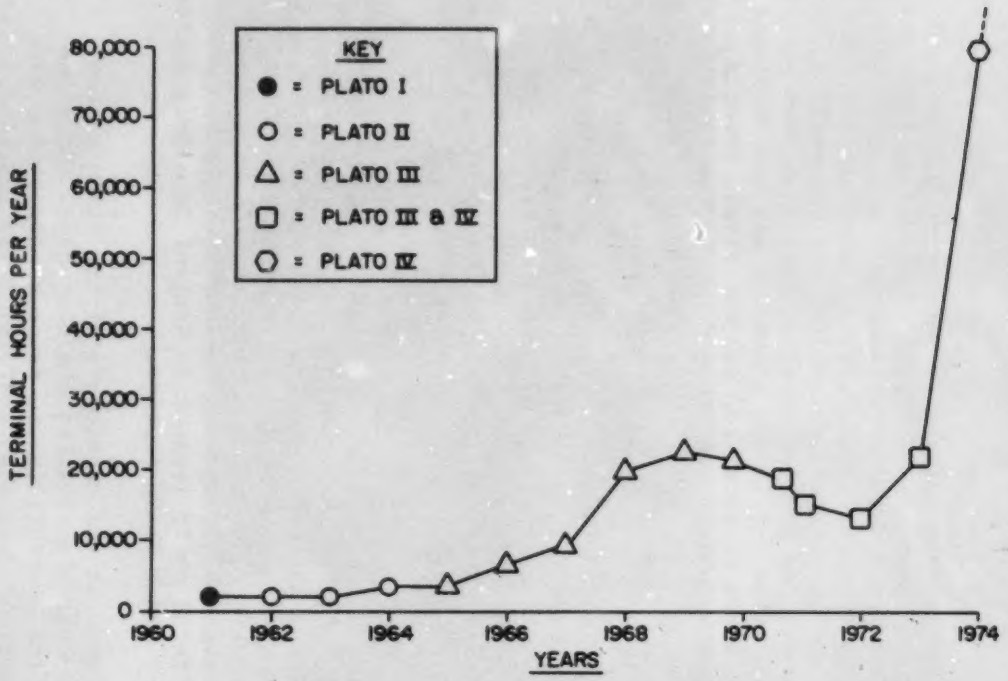

Figure 6 PLATO System Usage - 1960 to 1974 - Students Only

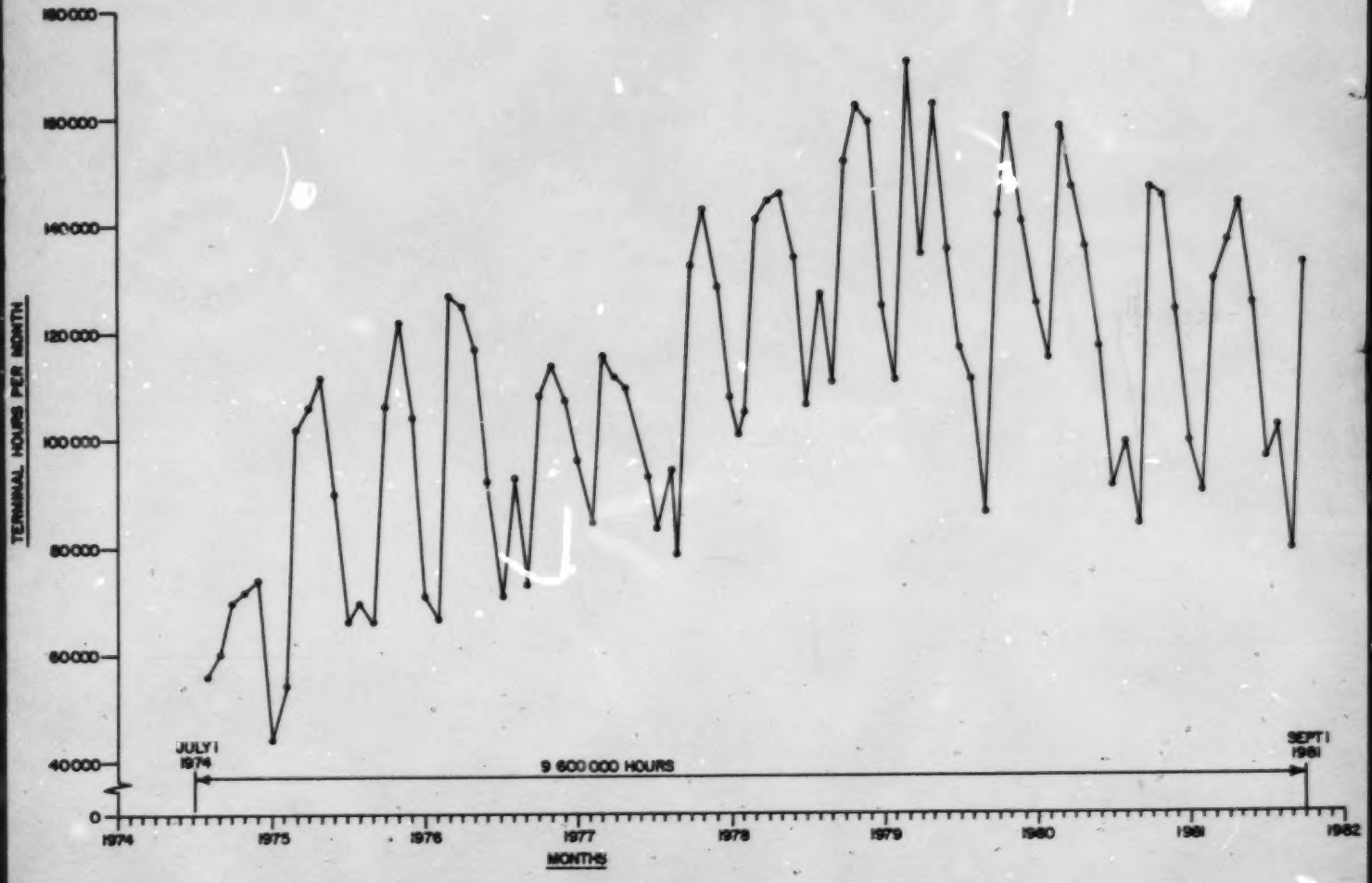

Figure 7 U of I PLATO SYSTEM USAGE - JULY 1, 1974 to SEPT 1, 1981
STUDENTS AND AUTHORS

Principal Financial Supporters of the CERL PLATO System

The PLATO project in the Coordinated Science Laboratory

1962-1967 Departments of the Army, Navy, and Air Force
Advanced Research Projects Agency

1966-1967 Control Data Corporation

1966-1968 United States Office of Education

The PLATO project in the Computer-based Education Research Laboratory

1967-1982 State of Illinois

1967-1982 Control Data Corporation

1967-1982 United States Department of Health, Education and Welfare
Bureau of Health Manpower
National Center for Health Services Research and Development
National Institute of Education
National Institute of Health
Public Health Service
Division of Nursing (through Mercy Hospital School of Nursing, Urbana, Ill.)

1967-1978 Owens-Illinois, Inc.

1968-1976 National Science Foundation

1971-1982 Department of Defense
Advanced Research Projects Agency
Army Research Institute
Office of Naval Research
United States Air Force

1971-1974 Ford Foundation

1971-1974 United States Agency for International Development

1974-1975 Kettering Foundation

1979-1982 Department of Labor

1972-1982 Many participating institutions (public, private, educational, industrial) among which are
Champaign Unit 4 School District
Chicago City Colleges
Parkland College
Urbana School District 116

Highlights in the History of the PLATO Project

The PLATO project in the Coordinated Science Laboratory

June 1960	Completion of first design for the PLATO system single station consisting of keyset and CRT with provision of simultaneous display of computer-generated characters and photographic slide)
Fall 1960	Project in regular research operation in the Coordinated Science Laboratory (two hours a day using ILLIAC I computer)
November 1960	First formal demonstration of the PLATO system in operation
January 1961	PLATO II in operation (two stations operating simultaneously)
March 1961	First use of a remote terminal (thirty miles from the computer)
Spring 1961	The PLATO terminal first used with instructional material (high school math and French grammar)
Fall 1961	College level material first presented on a PLATO terminal (Network Synthesis lessons)
Spring 1962	PLATO terminals first used to provide part of an accredited college course (Math 195, University of Illinois)
Summer 1962	Inquiry type logic developed for PLATO teaching
November 1962	PLATO system first used to collect and process physiological information (heart rate) as part of student response data
January 1963	Graduation of PLATO project operation from the ILLIAC I computer to using the Coordinated Science Laboratory CDC 1604
Spring 1963	The PLATO system first used to provide part of an accredited professional course (Nursing)
Fall 1963	PLATO III operative (capability for expansion to thirty-two stations)
June 1964	Two different lessons simultaneously available to a class using PLATO instruction
October 1964	Provision for inter-terminal communication between PLATO terminals completed

Fall 1964	PLATO terminals used for control of real experiments in physical sciences (all stations able to observe outcome and perform analysis of results)
December 1964	On-line editing of PLATO lessons possible while students use lessons
January 1965	CATO (Compiler for Automatic Teaching Operations) completed
Spring 1965	PLATO instruction first used for extensive portion of accredited course (EE 322)
Fall 1965	First college course (Library Science 195) given completely by PLATO instruction
March 1966	Expansion of PLATO III to twenty terminals completed
May 1966	Receipt of the PLATO Project's own 1604 computer with direct support from the Control Data Corporation
Summer 1966	Multiple on-line author editing program first used (MONSTER tape editor)

The PLATO project in the Computer-based Education Research Laboratory

January 1967	Computer-based Education Research Laboratory (CERL) formed for continued operation of and research on the PLATO System
Summer 1967	TUTOR author language first used on the PLATO (initially designed for authors with no background in computer use)
March 1968	NSF grant awarded for first steps in development of PLATO IV (ultimately to consist of more than 1000 terminals requiring only telephone line communication with a large central computer). Terminals use the plasma display panel developed at the University of Illinois instead of the more costly CRT presentation
June 1968	Disk storage added giving on-line editing capability to authors while students are operating (any combination of up to twenty authors or students simultaneously operating)
June 1968	Delivery of first commercially produced 4"x4" plasma panel (Owens-Illinois)
December 1968	Fourteen station remote PLATO demonstration center in operation at Mercy Hospital (three other centers operating by February, 1969)
June 1969	Multiple disk storage in operation. Up to 150 lessons available to students (for use) or authors (for editing during a class session)

November 1969	One remote station operating at Springfield High School, Springfield Illinois, ninety miles from Urbana
Summer 1970	720 hours of instructional material developed; 100,000 student contact hours of use by this date
January 1971	On-line remote demonstration for NSF in Washington, D.C.
May 1971	Delivery of first 512x512 Digivue display memory device from Owens-Illinois
June 1971	Delivery of first PLATO IV terminal from Magnavox Company
Summer 1971	1100 hours of instructional material developed. 130,000 student contact hours of use by this date
January 1972	Four PLATO IV terminals in operation
June 1972	Twenty PLATO IV terminals in operation. On-line PLATO IV demonstrations between January 1972 and June 1972 in many locations from California to Massachusetts, Canada to Texas
Summer 1972	On-line PLATO IV demonstrations in Italy, Germany, and Switzerland
August 1972	Forty PLATO IV terminals in operation
Fall 1972	Intensive PLATO IV lesson development
Winter 1972	250 PLATO IV terminals in operation at approximately forty locations (fifteen on the University of Illinois campus and about twenty-five off campus)
February 1973	CDC CYBER 73-24 computer installed replacing the CDC 6400
June 1973	Phasing out of the use of the PLATO III system for teaching
June 1973	PLATO on-line demonstration in Mexico
September 1973	PLATO on-line demonstration in Sweden
Fall 1973	300 PLATO IV terminals in operation at fifty sites
November 1973	PLATO on-line demonstration in the Soviet Union - five terminals, Russian keysets

Winter 1973-1974	Second PLATO system started by Control Data Corporation in Minnesota
January 1974	500,000 words of extended core storage (ECS) added
February 1974	1500 hours of available PLATO IV instructional material. 1500 more hours of instructional material in preparation. Over ninety college courses using the PLATO system
March 1974	450 terminals operable; new disk system operational (CDC 844)
April 1974	Second PLATO system operational at Control Data Corporation, Minneapolis, Minnesota
July 1974	700 terminals operable; 2500 hours of available curricular materials
Summer 1974	PLATO on-line demonstration in Bucharest, Rumania
September 1974	Formal external PLATO evaluation started by the Educational Testing Service for NSF
Fall 1974	PLATO terminals located at approximately 100 sites: twenty-three sites on the campus at the University of Illinois, eight in elementary schools, one in a high school, as well as terminals at about forty colleges and universities, seventeen government projects and twelve miscellaneous sites
Fall 1974	Third PLATO system in operation at Florida State University, Tallahassee, Florida
December 1974	Addition of 1,000,000 words of extended core storage
Spring 1975	Many lessons written in other CAI languages (particularly medical lessons) being translated to TUTOR for use on the PLATO system
Summer 1975	PLATO IV terminals located at 146 sites: twenty-six sites on the University of Illinois campus, ten elementary schools, three high schools, six community colleges, twenty-two government-supported institutions, thirty-one medical sites (seventeen situated at colleges or universities), thirty-two colleges and universities, sixteen miscellaneous sites
November 1975	One million terminals hours of usage by students and authors logged in the period between January 1, 1975 and November 19, 1975. Approximately 1500 authors on the system using 11,000 lesson spaces of which over 4500 are considered "finished lessons" varying in student completion time from a few minutes for some to several hours for others

March 12, 1976	Control Data Corporation - University of Illinois legal agreement signed, confirmed by the University of Illinois Board of Trustees on April 14
April 1976	Control Data Corporation public announcement of plans for marketing the PLATO system
May 1976	2,000,000 terminal hours of PLATO IV use between July 1, 1974 and May 24, 1976
August 1976	University of Quebec, Quebec, Canada - fourth PLATO IV system. Approximately 5000 hours of available instructional material on the University of Illinois system. PLATO lesson publication initiated by Control Data Corporation
Fall 1976	140 sites on the University of Illinois PLATO IV system: twenty-six on campus, nine elementary schools, six high schools, six community colleges, twenty government related installations, twenty-seven medical sites (fifteen at colleges or universities), thirty colleges and universities, and about twenty miscellaneous installations
September 1976	CDC Cyber 73-24 and CDC 6500 running simultaneously operating the University of Illinois PLATO system
1976	Remote demonstrations in Hawaii, Iran, Australia and Venezuela
January 1977	System output rate changed from 1260 to 1200 bits per second
April 1, 1977	Three million contact hours (students and authors) logged on the University of Illinois PLATO system since July 1974
Spring 1977	Installation of one million words of auxiliary memory (AMS)
June 1977	Terminals installed in Honolulu, Hawaii
Sept. 1977	First regular delivery of PLATO V (PPT) terminals
Jan. 14, 1978	Four million terminal hours of usage by students and authors since July 1, 1974. 158 sites on the U of I PLATO system
February 1978	Two new systems added to the PLATO network, one in Brussels, Belgium and one at the University of Delaware in Newark, Delaware
April 1978	Communication link now in use between University of Illinois, Arden Hills, Quebec and Brussels systems.

August 1978	5,000,000 contact hours logged on the University of Illinois PLATO system since July 1974.
Fall 1979	Ten PLATO systems in operation.
October 1979	195 sites on the University of Illinois PLATO IV network: forty-seven on-compus, eight elementary schools, five middle and high schools, ten community colleges, thirty-three government sites, twelve hospitals, forty-six colleges and universities, thirty-four business, industrial, and private installations.
November 1979	7,000,000 contact hours logged on the University of University of Illinois PLATO system since July 1974.
March 1980	Eleven operational PLATO systems, eight in the United States, one in Canada, one in Europe and one in South Africa.
September 1981	Seventeen operational PLATO systems, seven in the United States, two in Canada, four in Europe, two in South Africa, and one each in Australia and Korea.
September 1981	9,600,000 contact hours logged on the University of Illinois PLATO system since July 1974.
October 1981	200 sites on the University of Illinois PLATO IV network: forty-nine on the campus of UIUC, eight elementary and middle schools, eight high schools and adult education centers, twelve community colleges, twenty-six government-supported installations, forty-four colleges and universities (excluding UIUC), ten hospitals, six libraries, nine correctional institutions, and twenty-eight miscelaneous business, industrial and private sites.

CHRONOLOGICAL LIST OF PLATO PUBLICATIONS

A bibliography of PLATO articles appears on the following pages listed in chronological order of publication.

Articles in the bibliography marked with the symbol (#) may be purchased from CERL. Xerox copies of out-of-print CERL articles may be ordered at the price of ten cents per page. Some reports may be procured through the ERIC Clearing House.

Orders for CERL reports should be sent to:

PLATO Publications
Computer-based Education Research Laboratory
252 Engineering Research Laboratory
University of Illinois
103 S. Mathews
Urbana, Illinois 61801-2977

PLATO ARTICLES PUBLISHED IN 1961

Bitzer, D. L. and P. G. Braunfeld, "Automated Teaching Machine (PLATO)," Patent Disclosure (April 6, 1961).

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Easley, J. A., Jr., H. M. Gelder, and W. Golden, "A PLATO Program for Instruction and Data Collection in Mathematical Problem Solving," CSL Report R-185, U of I, Urbana, Ill. (1964).

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